How Does the Institutional Setting for Creditor Rights Affect Bank Lending and Risk-Taking?

Tianshu Zhao

Victor Murinde

Kupukile Mlambo

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HOW DOES THE INSTITUTIONAL SETTING FOR CREDITOR RIGHTS AFFECT BANK LENDING AND RISK-TAKING?

Tianshu Zhao, University of Stirling

Victor Murinde, University of Birmingham

Kupukile Mlambo, African Development Bank

Abstract

This paper investigates how the institutional setting for protection of creditor rights affects bank lending and risk-taking. An analytical model is specified to underpin banks' portfolio decisions, between loans and other earning assets such as government securities. The model is augmented with various metrics, which proxy the institutional setting for creditor rights, and is estimated and tested on an unbalanced three-dimensional dataset of commercial banks in 20 African countries for 1995-2008. It is found that three specific metrics induce banks to allocate a high proportion of their earning assets to loans: legal creditor rights; the efficient enforcement of creditor rights; and availability of information sharing mechanisms among banks. However, the three metrics appear to work through different channels. The enforceability of legal rights works not only through mitigating credit risks, but also through a composite effect of market competition and lower costs of information acquisition and contract enforcement. The legal rights metric and information sharing metric exclusively rely on the composite effect.

Keywords: Creditor rights; Law enforcement; Information sharing; Bank lending; Bank risk-taking; Africa

JEL Classification: D23, G21, G28, G32, K10, K42

1. Introduction

There has been considerable interest in the role of non-market institutions in explaining economic growth (Henisz, 2000; Deaton, 2010). Research on institutional setting and economic growth generally concedes that the institutional framework (such as the protection of rights of parties involved in a contract, the quality of judicial enforcement and economic freedom) affects economic growth and crucially defines the incentives and constraints in a world characterized by imperfect information and incomplete contracts (Rodrik, 2000). It is argued that good quality non-market institutions reduce the cost, and increase the efficiency, of enforcement of contracts as well as improve the temperament and motivations of the participants involved (North, 1990). In addition, research on finance and development has accumulated robust evidence that a well-functioning banking system is strongly and causally associated with economic growth (DemirgucKunt and Levine, 2008). It is argued that banks exist because of incomplete and asymmetric information in financial markets (Neuberger, 1997). Also, banks contribute to economic growth by easing the capital accumulation process, not only through intermediating savings into investment but also through mitigating information asymmetry and agency costs between lenders and borrowers.

The important insights provided by the role of institutional setting in the literature on financial development and economic growth offer justification for the growing research on the association between the institutional setting for the protection of creditor rights (encompassing legal rights for creditors, the enforcement of legal rights and information sharing mechanism among creditors) and the development of the credit market. Although banks play the special role as financial intermediaries and information processors, their incentives, capacity and efficiency to carry out their function are subject to the rules that govern and shape the interactions among banks, borrowers and other players in the market place. Indeed, starting from the seminal paper of La Porta, Lopez-de-Silanes, and Vishny (1998, henceforth LLSV), a series of research in the law and finance literature, based on country-level aggregate data, has established a general consensus that the quality of the legal protection, the enforceability of legal rights and the improvements in information sharing among creditors, are positively associated with the depth of financial system[1] (LLSV, 1997, 1998; Levine, 1998, 1999; Jappelli and Pagano, 2002; Djankov et al., 2007). Also, strong

[1] In the cited papers, the common indicators used for financial depth are the ratio of private credit to gross domestic product and the degree to which the central bank versus commercial banks is allocating credit.

institutions for ensuring law and contract enforcement and for information sharing among banks appear to be necessary characteristics to reduce the fragility of the banking sector (Demirgüç-Kunt and Detragiache, 1998; Jappelli and Pagano, 2002).

Although existing theory offers testable propositions on the channels through which institutional settings for the protection of creditor rights get transmitted to the credit market, there is scant micro-analysis to identify and quantify the specific mechanisms (Haselmann, 2010). Also, in contrast with the general agreement reached by the empirical research at the macro-level, the microeconomics evidence is controversial (Houston et al., 2010). Moreover, the literature tends to focus on the quantity of credit supplied by banks and banks' risk taking behaviour, and generally overlooks banks' operating costs associated with producing information and enforcing loan contracts and on the degree of competition in the credit market. Given the observation that the credit market is characterized not only by incomplete information but also by imperfect competition, it is plausible to argue that banks' portfolio decision making is a net reflection of credit risk, the cost of financial intermediation and the competitiveness condition in the market place (Freixas and Rochet, 1997).

Hence, this paper seeks to identify and quantify specific mechanisms through which the institutional setting for protection of creditor rights impacts on bank lending and risk-taking. An integrated analytical model is specified to show how banks' asset-allocation decisions, between loans and the competing stock of other earning assets, depend on: risk and return; bank-specific elasticity of supply; and operating costs. The model is augmented with metrics which proxy the institutional setting for protection of creditor rights, and is then estimated and tested on an unbalanced three-dimensional dataset of commercial banks in 20 African countries for the period 1995-2008.

To the best of our knowledge, this study presents the first integrated analysis of how the institutional setting for the protection of creditor rights affects the credit risks faced by banks, the degree of competition in the credit market, and banks' operating costs associated with acquisition of information and contract enforcement. It is expected that the evidence generated by the study will not only yield valuable insights into the inconsistency between macro and micro literature but it will also offer important implications for the formulation of policy initiatives to achieve an efficient credit market.

The empirical application of our analytical approach to banking in Africa is timely. In many African countries, banks are predominant in the financial system and bank loans are the primary external financing source for firms (Kirkpatrick, et al., 2008). Moreover, since the

1980s, most African countries have initiated various financial reforms aimed at promoting efficient credit markets. However, the reforms have failed to deliver increased financial intermediation (Kasekende, et al., 2009). While there are sizable differences between different countries within the region, financial sectors in Africa are among the shallowest in the world (McDonald and Schumacher, 2007). Credit to the private sector provided by the banking sector as a percentage of GDP has been declining over years. Curiously, this outcome cannot be attributed to the shortage of bank liquidity; many African banking systems are fairly liquid by international standards. It is rather a result of banks' preference for allocating the financial resources they have mobilized to other earning assets, particularly safer government securities, over private credit (Allen et al., 2010). Among several reasons that have been identified to explain the dysfunctionality in financial intermediation, the important factors include high risks and costs of financial intermediation, induced by the absence of strong institutional infrastructure (Honohan and Beck, 2007)[2]. There is a general consensus that bank regulatory reforms cannot be viewed in isolation from policies and regulations by national institutions. Given ongoing efforts to correct the weaknesses and provide an enabling institutional environment for African banking, and the high hopes which policy makers place in those efforts, there is a need for empirical analysis of institutional settings which influence banks' provision of loans.

The remainder of this paper proceeds as follows. Section 2 lays out the detailed structure of the general model of portfolio selection which specifically allows for risk and imperfect competition as well as cost of financial intermediation. Section 3 reviews the various channels proposed by the literature to capture the effects of creditor rights, the enforcement of legal rights and information sharing on credit market performance. Section 4 describes our empirical design, measurement of variables and data. The estimation and testing results are discussed in Chapter 5. Section 6 concludes.

2. A model of banks' portfolio allocation

Our analytical framework for a bank's portfolio allocation, between private credit (loans) and other earning assets, is based on profit maximization as the objective function. The model is closely related to Klein (1970), Klein (1971) and Hannan (1991). Rather than providing a comprehensive theory of the banking firm, the model is used to underpin how banks'

[2]Honohan and Beck (2007, p.16) identify the key factors, namely, "... rationalization and clarification of laws, streamlining of court procedures, establishment of credit registries, and training of financial professionals."

portfolio allocation behaviour is influenced by differences across competing types of earning assets, in terms of risk and return characteristics, the elasticity of supply, and the marginal operating cost, among other considerations.

We assume bank *i* has two primary sources of loanable funds, one is equity (E_i) invested in the bank and the other is deposits (D_i) mobilized by the bank. The bank allocates aggregate loanable funds between a single aggregate loan (L_i) and a single aggregate competing stock of other earning assets, i.e. government securities (S_i). Therefore, the bank's balance sheet identity is $L_i + S_i = D_i + E_i$, and $E_i / L_i = \delta_i, 0 < \delta_i < 1$, which indicates the level of capitalization of the bank.

We assume the credit market structure is oligopolistic, where bank *i* operates among other *N-1* banks, given price of deposits and non-interest operating cost.

The bank faces a downward sloping demand curve. The contract rate of interest is $r_L^i(L_i)$. The revenue associated with the provision of loans is $r^i{}_L(L_i)L_i$ when all the loans are repaid. In the event of default, when the loss is larger than zero, the expected revenue associated with loans is $u_i r_L^i(L_i)L_i$, where u is a product of the probability of recovery given default and the probability that the loan will default. Because $u \leq 1$, 1-u therefore stands for the virtual default risk faced by the bank. The term u is exogenously given for the bank's decision at time *t*.

Following stylized models of the banking firm, we assume government securities are free of default risk and are in perfect elastic supply to the bank (i.e. a perfectly competitive market since each individual bank is one of an infinite number of other operators in the market). Thus, the revenue associated with holding government securities by bank *i* is $r_s{}^t S_i$, where r_s is the interest rate on government securities. Since in addition to an administrative cost incurred on government securities, loans have an additional operating cost of dealing with asymmetric information and enforcing repayment in the case of default, marginal variable operating cost of loans is expected to be larger than that of government securities.

The expected profit of bank *i* at time *t* can be written as[3]:

$$\pi_i^{\,e} = u_i r_L^i(L_i) * L_i + r_s * S_i - r_D * D_i - \delta_i L_i r_c - C_i(L_i, S_i, D_i) - C_{fi} \qquad (1)$$

[3] The flat risk premium per unit of deposits is easily accommodated into the interest rate of deposits.

Where $C_i(L_i, S_i, D_i)$ indicates the overall operating cost of the bank (i.e. non-interest operating cost), which is a function of the quantity of loans, the quantity of government securities and the quantity of deposits; C'_L and C'_s are marginal variable operating cost of loans and government securities; r_D is the interest rate of deposits; r_c is the interest rate on financial capital[4]; and C_{fi} = fixed costs.

The bank chooses the quantity of loans and government securities in order to maximize the expected profit expressed in Equation (1), subject to its balance sheet constraint. The first-order conditions for the bank's expected profit maximization yields the following equations, where τ is the Lagrangean multiplier:

$$\frac{\partial \pi^e{}_i}{\partial L_i} = r_L^i u_i + u_i L_i * \frac{\partial r_L^i}{\partial L_i} - C'_{L(i)} - \delta_i r_c - (1-\delta_i)\tau = 0 \quad (2)$$

$$\frac{\partial \pi^e{}_i}{\partial S_i} = r_s - C_s - \tau = 0 \quad (3)$$

Manipulating equation (2), we obtain[5]:

$$\frac{\partial \pi^e{}_i}{\partial L_i} = r_L^i (1 - \frac{1}{e_L^i}) u_i - C'_{L(i)} - \delta_i r_c - (1-\delta_i)\tau = 0 \quad (4)$$

Where $e_L^i = -\frac{\partial \ln L^i}{\partial \ln r_L^i}$ is the demand elasticity for loans of bank *i*, as an indicator of the bank's market power. From (4) and (3), we obtain:

$$\frac{1}{1-\delta_i}[r_L^i (1 - \frac{1}{e_L^i}) u_i - C'_L - \delta_i r_c] = r_s - C'_{S(i)} \quad (5)$$

In Equation (5), the left hand side is the marginal return on government securities, while the right hand side is the expected marginal return on loans (adjusted for the capitalization of the bank). Let X_L be the proportion of total loanable funds allocated by the bank to loans, and X_S is the proportion of total loanable funds allocated by the bank to

[4] In Dermine (1986), it was explained as a proxy for the opportunity cost of equity capital.

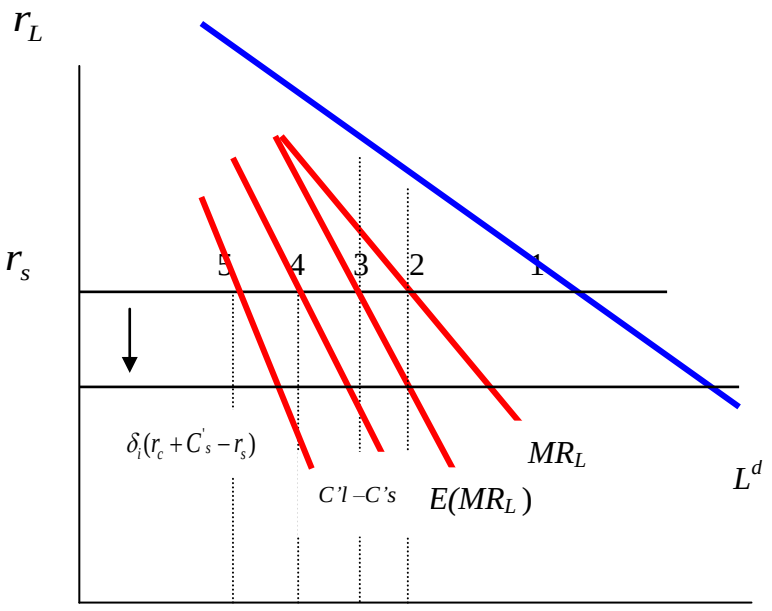
[5] As noted by Klein (1970, p.492), "what is particularly interesting about this framework is that it allows explicitly for difference in loan demand confronting banks and for differences in the elasticity of demand for bank loans". The framework is not constructed as a loan supply curve; rather, it is a reduced form equation relating the equilibrium loan/total earning asset ratio to variables which are exogeneous to the bank.

government securities, and $X_L + X_S = 1$. Thus, X_L is chosen by the bank at the point at which the expected marginal return on loans is equal to the marginal return on government securities.

Equation (5) can be rewritten as:

$$r_L^i\{1-\frac{1}{e_L^i})u_i - \{(C'_{L(i)} - C'_{S(i)}) + \delta_i(C'_{S(i)} - r_s + r_c)\} = r_s \qquad (6)$$

Figure 1: Equilibrium for loans



Quantity of loans

Figure 1 decomposes the determinants of the equilibrium level of the quantity of loans for the bank implied in Equation (6). Line 1 (L^d) indicates the downward demand curve faced by bank *i*. Line 2 (MR_L) is the marginal revenue of loans. The difference between line 1 and line 2, or the quantity of loans in equilibrium, is attributable to the presence of market power. The larger degree of market power (i.e. a lower degree of competition in the market place) is associated with a larger difference in the quantity of loans, c*eteris paribus*. Line 3 (E(MR_L)) is the expected marginal revenue of loans. As indicated above, the presence of the loss upon default is the reason for the divergence between line 2 and line 3. The larger the risks upon default, the larger the decrease in the quantity of loans, c*eteris paribus*. The further

left-hand shift from line 3 to line 4 is due to additional marginal operating cost of loans associated with asymmetric information, relative to government securities. The larger difference is related to a larger decrease in the equilibrium level of the quantity of loans, *ceteris paribus.*

The effect of an increase in bank capitalization depends on the sign of $(r_c + C'_s - r_s)$. In the case where $(r_c + C'_s - r_s) > 0$, the increase in capitalization induces a decrease in the quantity of loans, corresponding to a shift from line 4 to line 5. The assumption that the government securities market is perfectively competitive implies that $r_D + C'_s = r_s$, i.e. marginal cost of government securities equals the interest rate on the securities. Hence, the sign of $(r_c + C'_s - r_s)$ is determined by whether equity capital is more expensive than deposits[6]. A negative relationship between capitalization and the quantity of loans suggests that higher capital costs induce a reduction in bank loans. The decrease in risk-free rate of interest r_s would result in the increase in the difference between $r_L - r_s$, thereby inducing an increase in the quantity of loans[7], and *vice versa.* Overall, the proportion of total loanable funds allocated by the bank to loans (X_L) is given by (7), with the theoretical predicted effect of each determinant.

$X_L = f(r_L - r_s,$ *competition, loss on default, MC of IP, capitalization)* (7)

(+) (+) (-) (-) (?)

Where MC of IP is the marginal cost of information acquisition.

3. Institutional setting for the protection of creditor rights

Our central argument is that the institutional setting for the protection of creditor rights (specifically, legal rights for creditors, the efficient enforcement of the legal rights, and availability of information sharing mechanisms among banks) influences the degree of competition in the credit market, the default risk banks take, and the operating cost paid by banks to acquire and process information. In turn, these considerations affect banks' portfolio allocation in terms of the proportion of total loanable funds allocated to loans rather

[6] The theoretical literature assumes that equity capital is more expensive than deposits; the assumption is justified by adverse selection and moral hazard considerations (Thakor, 1996).

[7] Since in reality a change in the risk-free rate of interest will raise interest rates generally, the bank's asset allocation will depend on the relative rate of interest.

than government securities. We review the theoretical ideas and empirical findings that underpin our argument.

3.1 Theory

Two competing views, identified by Djankov et al. (2007), which explain the quantity of private credit supplied by banks are the information theory of credit and the power theory of credit. The two theories focus on different stages of the loans contract and suggest that the bank's willingness to grant credit depends on: perception of the likelihood of the borrower's repayment; the possibility of recovery in the case of default; and the costs of screening, monitoring and enforcing loan contracts.

The information theory of credit underpins the importance of a bank's knowledge about the ability and willingness of the borrower to honour the loan contract. The asymmetric information between borrowers and banks gives incentives for less-informed banks to acquire information; the more a bank invests in information acquisition, the more accurate is its prediction of the probability of repayment by the borrower and the better the quality of its lending (Jappelli and Pagano, 2002; Hyytinen and Toivanen, 2004). However, the increase in the intensity of information acquisition may result in higher operating costs for the bank. The presence of informational sharing institutions among banks about the characteristics of their borrowers, either via private credit bureaus or public credit registries, may enhance the bank's lending through reducing the cost of information acquisition. The exchange of information may not only enable the bank to distinguish between a good applicant and a bad one, but also it may incentivise the borrower to exert more effort to honour their debt obligation (Brown et al., 2009).

Hence, availability of informational sharing among banks helps reduce operating costs, including the cost of screening potential borrowers *ex ante* and that of monitoring existing loans contract. The quality of lending is enhanced by the mitigation of adverse selection *ex ante* for loan contracts and mitigation of moral hazard during loan contracts.

While the information theory of credit mainly focuses on the role of institutional setting for a cost-effective prevention of default, the power theory of credit is based on the transfer of control rights upon default. Stronger legal rights give the bank more power to force repayment by seizing collateral, or even by taking control of the borrower's *ex post* contract, during default. This leads to a higher recovery rate in the event of default and a decrease of the default risk banks eventually bear. In addition, efficient judicial enforcement

of legal rights reduces the uncertainty and cost faced by the bank in pursuing repayment. Hence, banks which operate in an institutional environment characterised by higher legal creditor rights and more efficient enforcement of these rights show more willingness to provide credit, even with limited information about the borrower. Although the power theory of credit mainly emphasizes the recovery of bad loans, it has implications for the prevention of bad loans. Arguably, the power of creditors endowed by better institutional protection creates a more credible threat to borrowers to perform in line with the bank's interest, which attenuates the credit risk associated with moral hazard on part of borrowers and the bank's cost of dealing with moral hazard and adverse selection.

However, the argument that stronger creditor rights and information sharing lead to a lower default rate is only valid with respect to an individual borrower and if the bank does not change its incentives to acquire information about the borrower (Jappelli and Pagano, 2002; Brown et al., 2009; Houston et al., 2010). In the case where the informational opaqueness of an individual borrower and the losses of the bank decrease when a given borrower defaults, the marginal benefit of banks' information production also decreases, so does banks' effort to gather and process extra information about the borrower. Banks may be inclined to reduce the number of covenants in the financial contract (Houston et al., 2010). As a result, the probability of default of a given borrower may increase. Also, even if stronger creditor rights and information sharing really lead to a lower default rate of an individual borrower, such effect may not necessarily translate into a decrease in the average default rate of the loan portfolio if there is concomitant change in the bank's willingness to grant credit to riskier and previously rationed borrowers (Brown et al., 2009; Laven and Majnoni, 2005). If the relative weight of lower-grade borrowers increases in the loan portfolio, the average default rate of the loan portfolio would increase although the probability of default rate of each borrower decreases. Similar to the case of a given borrower, whether the actual average losses of the loan portfolio increase or not depends on the extent to which a higher recovery rate compensates for a higher default rate (Houaton et al., 2010).

Also important is the influence of the institutional setting for the protection of creditor rights on the degree of competition in the credit market, which in turn leads to the change in the quantity of credit supplied by banks. As opposed to other markets, an idiosyncratic barrier that undermines the contestability in the credit market is the information advantage of the inside bank compared to outside banks (Boot, 2000; Sengupa, 2007). The repeated interaction with the same customer over time or across products entails a lower information asymmetry

between the inside bank and its borrowers. In recognition of the information advantages of the inside bank, outside banks are cautious to distinguish between the "lemons" rejected by the inside bank and creditworthy borrowers seeking to mitigate the "hold up" problem of their existing banking relationship. Such a "winner's curse" problem deters other incumbent banks to compete with the inside bank for borrowers and hinders potential entrants to materialize their entry intention. Informational sharing among banks reduces the informational disadvantage of the outside banks in *ex ante* loan contracts. Strong legal protection *ex post* strengthens the efficacy of collateral used by outside banks to bridge the information gap *ex ante* and to seize collateral as a defensive line in the event of default. This allows outside banks to bid more aggressively with the inside bank. In this way, stronger creditor rights and information sharing contribute positively to the enhancement of competition in the lending market and lead to greater credit supply (Barth et al., 2009).

3.2 Empirical literature

The existing empirical literature suggests that the quality of the legal framework for the protection of creditor rights is important in influencing the quantity of credit supply. The evidence also indicates that the legal enforceability of financial contracts is more important than the legal codes in stimulating a larger volume of credit. Using bank-level data in both developing and developed countries over the period 2000-2006, Cole and Turk-Ariss (2010) find that banks allocate a smaller portion of their assets to loans when creditor rights are stronger, while the opposite is true when the legal enforcement of creditor rights is more efficient. The findings appear to be consistent with those obtained by Bae and Goyal (2009), who show that the enforcement of contracts, rather than the legal right of creditors, generates a significant impact on increasing loan quantities. Furthermore, Safavian and Sharma (2007) analyse firm-level data on 27 European countries in 2002 and 2005, and find that the positive impact of legal rights on firms' access to bank credit decreases with the decrease in the efficiency of courts. Therefore, poor enforceability of creditor rights diminishes the positive impact of legal rights on the quantity of credit supply. The results obtained by Safavian and Sharma (2007) are consistent with the argument put by Berkowitz, et al. (2003) and Pistor, et al. (2000), that the effectiveness of the law is more important than the written law in promoting financial development for transition and developing countries. Given the fact that law is a transplanted institution for most of those countries, the readiness and the competence of the recipient country are crucial for the legal system to work. Regarding the implications

of information sharing for banks' credit supply, Love and Mylenko (2003) use cross-section firm-level data and find that private informational sharing facility are associated with lower financial constraints perceived by firms. Similarly, Brown et al. (2009) find that information sharing is associated with improved credit availability in a cross-section of firms in transition economies. Further, it is shown that banks are motivated by informational sharing opportunities to provide loans to riskier and previously rationed borrowers; in fact, the positive association between information sharing and credit availability is found to be stronger for small and young firms (Love and Mylenko, 2003; Brown et al., 2009). In contrast, Bennardo et al., (2009) indicates that the improvement of bank's knowledge that borrowers have multiple lending relationships as a result of information sharing among banks induces the bank to ration credit, for fear of increased default probability of a given borrower due to the large total exposure of the borrower.

To the best of our knowledge, there are only two studies that use bank-level data to investigate the link between the legal framework for the protection of credit rights and banks' risk-taking behaviour. Godlewski (2006) analyses 297 default banks for the period 1990 - 2002 in 34 emerging market economies and finds that banks' risk taking behaviour is negatively affected by quality of the rule of law and bank's default probability is positively related to the excess risks taken by banks. In contrast, Houston et al. (2010) find that stronger creditor rights tend to promote greater risk taking of banks and increase the likelihood of financial crisis in a large cross-country study during 2000-2007. On the other hand, the empirical evidence derived from firm-level data is controversial. John et al. (2008) find that increase protection on investors leads to higher firm-level riskiness. However, Acharya et al., (2009) suggest that stronger credit rights encourage management of firms to reduce corporate risk-taking through diversifying mergers and adopting appropriate operating policy.

The existing empirical evidence appears to confirm the positive impact of information sharing among lenders on the probability of default of individual borrowers. Kalberg and Udell (2003) document that availability of trade credit history reports, compared to financial statements alone, improves default predictions. Also, Brown and Zehnder (2007)'s experimental study suggests that the presence of information sharing increases an individual borrower's repayment rate in the case where the mobility of borrowers across banks is high. However, Houston et al. (2010) find that greater information sharing leads to decreased bank risk, and reduced likelihood of a financial crisis. From a different perspective, Barth et al,

(2009) find that information sharing reduces lending corruption, and helps enhance the positive effect of competition on curtailing lending corruption.

Despite the plethora of research on the quality of institutions and competition in the economy (Acemoglu, et al., 2001), there is sparse empirical research on the impact of the legal framework for the protection of credit rights and information sharing on the cost of financial intermediation and the degree of competition in the lending market. Three exceptions, closely related to this research, are Claessens and Laeven (2004), Demirgüç-Kunt et al., (2004), and Laeven and Majnoni (2005). Claessens and Laeven (2004) measure the degree of competition at the industry-level, by estimating the extent to which changes in input prices are reflected in revenues earned by specific banks in 50 countries' banking systems. It is found that the quality of protection of property right, a broad measure of the quality of legal framework, does not exercise an independent effect on competition. However, Demirgüç-Kunt et al. (2004) measure the quality of institutions by national indicators of economic freedom, or property rights protection, and find that a better quality of institutional indicator is associated with lower net interest margins and overhead expenditures cross-bank. The findings suggest that the overall institutional environment is more conducive to private sector competition, by reducing market power, and the cost of financial intermediation. Laeven and Majnoni (2005) also find that the improvements in the quality of legal framework lower the country-level interest rate spread.

4. Empirical design, variables and data

4.1 Empirical specification

The analytical framework of a bank's portfolio allocation between loans and government securities, in Section 2, suggests that the proportion of total earning assets allocated by bank *i* to loans at time *t* is a function of the difference between the interest rate on loans and that on government securities (*MAR*), the degree of competition in the lending market (*COM*), the default risk facing banks involved in credit supply (*RISK*), the marginal information production cost of loans (*COST*), and the capitalization level of the bank (*CAR*). Hence, we specify the following model:

$$X_L = f(\underset{(+)}{MAR}, \underset{(+)}{COM}, \underset{(-)}{RISK}, \underset{(-)}{COST}, \underset{(?)}{CAR}) \qquad (8)$$

On the basis of the theoretical and empirical literature, reviewed in Section 3, it is plausible to hypothesize that legal rights for creditors (*LEG*), the enforceability of legal rights (*ENFOR*) and information sharing mechanisms among creditors (*SHAR*), influence the degree of competition in the lending market (*COM*), the default risk taken by banks (RISK) and the operating cost paid by the bank to acquire and process information (*COST*), and a vector of typical factors (*W*). Thus, we have:

$$COM_t = f(LEG, ENFOR, SHAR, W_{com}) \quad (9)$$

$$RISK_t = f(LEG, ENFOR, SHAR, W_{risk}) \quad (10)$$

$$COST_t = f(LEG, ENFOR, SHAR, W_{cost}) \quad (11)$$

Where, W_{com}, W_{risk} and W_{cost} are the vectors of stylized determinants for: the degree of competition in the credit market; the default risk taken by banks; and operating costs for acquiring and processing information, respectively.

Our objective is to examine the impact of legal rights for creditors, the enforcement of contracts and information sharing mechanisms among banks on the degree of competition in the lending market, the default risk banks are taking and the operating cost of banks to produce information, and through those channels to influence the credit supply of banks.

Hence, we adopt a two-stage analysis. In the first stage, in equation (12), we examine the influence of legal rights for creditors, the enforcement of contracts and information sharing mechanisms among creditors on the risk-taking behaviour by banks, controlling for other industry-wide and bank-specific variables. In the second stage, in equation (13), the credit risk predicted by the first equation is lagged one period and incorporated into a second regression equation to explain the proportion of total loanable funds allocated by the bank to loans, along with legal rights for creditors, the enforcement of contracts, information sharing mechanism among creditors and other industry-wide and bank-specific variables. By doing so, we essentially single out the influence of the institutional setting indicators on default risk, while combine other two channels into a composite effect. Notably, such procedure implicitly assumes the bank's decision making into a two-step process, i.e. the bank forms its perception (expectation) of default risk in the supply of credit at time *t* according to predetermined variables at the time *t-1*, and then decides how to allocate its assets between loans and government securities. Thus, the perception of default risk, which is determined

jointly by various incentives internal to the bank and certain institutional environment which truly is exogenous to the bank at time *t-1*[8], is exogenous to the bank's asset allocation decisions at time *t*. In detail, the estimating equations are:

$$RISK_{jit} = \beta_0 + \beta_1 LEG_{jt} + \beta_2 ENFOR_{jt} + \beta_3 SHAR_j + \gamma Z_{jt} + \eta M_{jt} + \xi B_{jit} + \ell \sum_{t=96}^{2008} TIME_t + \varepsilon_{jit} \quad (12)$$

$$X_{jLt} = \alpha_0 + \alpha_1 MAR + \alpha_2 \hat{RISK}_{ji(t-1)} + \alpha_3 LEG_{jt} + \alpha_4 ENFOR_{jt} + \alpha_5 SHAR_j + \nu R_{jt} + \lambda M_{jt} + \rho BANK_{jit} + \psi \sum_{t=96}^{2007} TIME_t + \omega_{jit} \quad (13)$$

Where, $RISK_{jit}$, the dependent variable of Equation (12), is the default risk of bank *i* in country *j* at time *t*, measured as the ratio of loan loss provision over total loans; the rest of the variables are defined and discussed below.

4.2 National institutional setting for the protection of creditor rights

Our main explanatory variables are national institutional setting for the protection of creditor rights; it includes the measures of legal right of creditors (*LEG*), the enforceability of legal rights (*ENFOR*) and information sharing among banks (*SHAR*).

To measure the strength of legal right of creditors, we create a rank order index based on the Creditor Right Index developed by Djankov et al. (2007) and the enhanced version of this index provided by the World Bank's Doing Business Index. Djankov et al. (2007) constructed the Creditor Right Index to measure the legal right of secured creditor in bankruptcy against defaulting borrowers for a sample of 129 countries over 1978-2003. It consists of four components: (i) whether secured creditors are able to seize their collateral once a reorganization petition is approved (no "automatic stay" on assets); (ii) whether a borrower filing for reorganization is subjected to creditor consent or minimum dividend; (iii) whether secured creditors are ranked the first in the distribution of proceeds of liquidating a bankrupt firm among other creditors (secured credit paid first); (iv) whether creditors or an administrator is responsible for running the business during reorganization, rather than having the debtor continue to run the business (no management stay). A value of one is given to each component, and the aggregated legal right index ranges from zero (poor creditor rights) to

[8] This kind of treatment can be recognized as the unobserved variable model used by Zellner (1970) and Goldberger (1972). In our context, the perception of virtual default risk of the bank is unobservable, but it is related to observed predetermined variables.

four (strong creditor rights). The index was further refined by the World Bank's Doing Business Report to include: (v) whether general rather than specific description of assets is permitted in collateral agreements; (vi) whether general rather than specific description of debt is permitted in collateral agreements; (vii) whether any legal or natural person may grant or take security; (viii) whether a unified registry including charges over movable property operates; (ix) whether parties may agree on enforcement procedures by contract; and (x) whether creditors may both seize and sell collateral out of court. Again, a score of 1 is assigned for each component. The inclusion of those six features of the law makes the index range 0 - 10, with higher scores indicating that collateral and bankruptcy laws are better designed to expand access to credit. The new index was updated annually by the World Bank's Doing Business Report 2004 onwards. To handle the incompatibility of the index before and after 2003, induced by the different composition of Djankov et al., (2007)'s index and that of the World Bank's Doing Business Report index, we follow Berger et al. (2005) and rank the index of each sample country for each year in ascending order and then convert to a uniform scale over [0, 1] using the formula (order − 1)/(n − 1), where order is the place in ascending order of the country in each year and n is the number of sample countries in that year[9]. The country with the highest index has the best rank of 1, and the country with the lowest index has the worst rank of 0. Thus, a country's rank in a year is the proportion of sample countries in that year with lower index, so a country with an index higher than 70% of other countries in that year has a rank that year of 0.70. The basic principal of the index is that higher values of the rank index indicate stronger creditor rights, for the country.

To measure the effectiveness of law enforcement (*ENFOR*), we use the "Rule of Law" index developed by Kaufmann et al. (2009). The variable reflects the perceptions of the extent to which agents have confidence in, and abide by the rules of, society and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. A higher index implies better enforcement. Moreover, since the indicator is constructed through reasonably comparable methodologies from one year to the next, it can be used to make comparisons of countries over time, and also can be used to compare different countries' scores in the same year (Kaufmann et al., 2009). The annual indicator is available for 212 countries in 1996, 1998 and during 2000-2008, while our sample period is 1995 - 2008. To make as much time variation in the indicator as possible,

[9] The correlation of our legal right index and Djankov et al.(2007)'s index is 0.9755 (significant at 1%).

we use the value in 1996 to proxy for 995 value, the arithmetic average of 1996 and 1998 to construct the indicator in 1997, and that of 1998 and 2000 to construct the indicator in 1999.

To capture information sharing among banks, we define a dummy variable (*SHAR*) with a value of 1 from the year when either a public registry[10] or a private bureau[11] starts to operate in a country and onwards, and 0 prior to it. The information about the timing when the information sharing mechanisms started to operate is collected from Djankov et al., (2007) and the World Bank's Doing Business Report.

4.3 Regulatory variables

We include proxies for regulations and supervision (Z_{jt}) in order to control for industry-wide institutional setting for bank risk taking. Specifically, we consider the stringency of regulatory capital requirements (*CAPRQ*), the power granted to authorities to intervene in bank management (*OFFPR*), private monitoring (*PRI*), regulatory restrictions on bank activities (*FREE*) and the existence of deposit insurance scheme (*INSUR*).

The main database for *CAPRQ*, *OFFPR*, and *PRI* consists of three surveys by the World Bank in 2000, 2003 and 2008[12]. We use the value in 2000 for the period 1995-2000, the value in 2003 for 2001-2003 and the value in 2008 for 2004-2008. *CAPRQ* accounts for the regulation regarding the source of funds that can be counted as regulatory capital, whether the sources have to be verified by the regulatory or supervisory authorities and whether risk elements and value losses are considered while calculating the regulatory capital. *OFFPR* relates to supervisory power in terms of prompt corrective action, declaring insolvency, and restructuring. For both *CAPR* and *OFFPR*, a higher value indicates stronger official regulation. Despite the expectation that higher capital stringency and stronger official power would prevent banks from excessive risk-taking behaviour, some theoretical contributions and empirical evidence seem to suggest otherwise. Using a mean-variance framework, Koehn and Santomero (1980) indicate that if capital is relatively expensive, the increase in the

[10] A public registry is a database owned by a public authority, say the central bank, which collects information on credit worthiness of borrowers and makes it available to financial institutions (Djankov et al., 2007).

[11] A private bureau is a private firm that maintains a database on credit worthiness of borrowers, which facilitates the exchange of information among banks and other financial institutions (Djankov et al., 2007).

[12]We construct the index for the three regulatory variables by designing 1/0 score for each question, following Fernandez and Gonzalez (2005), Pasiouras (2007), among others. An alternative approach is to use principal components analysis (PCA), as in Beck et al. (2006). Barth et al. (2004) use both approaches and note that the drawback of using the index is that it assigns equal weight to each of the questions, while the disadvantage of the PCA is that it is less obvious how a change in the response to a question modifies the index. While they only report the results from the latter approach, Barth et al. (2004) mention that "we have confirmed all this paper's conclusions using both methods" (p. 218).

stringency of capital requirement diminishes the bank's expected returns. The attempt of banks to restore the expected return would induce them to restructure investment towards the ones with higher risk and higher return. In the cases when the increase in the bank's risk overweighs the increase in capital, a higher default probability appears. In addition, if the purpose of the imposition of higher capital requirements is to enhance the ability of banks to internalize their risk taking, the requirements are likely to be companied by the increase in bank risk-taking (Altunbus et al., 2007). In addition, stronger power in supervising and regulating banks may imply a higher level of supervisory forbearance in case of imprudent behaviour by banks; thereby giving regulatory authorities greater leeway to abuse their power for private gain (Barth et al., 2003; Beck et al., 2006).

Our index of private monitoring (*PRI*) refers to the degree to which bank supervision forces banks to disclose accurate information to the private sector. Arguably, private monitoring exerts more effective governance compared to the official supervisory power because it is less likely to be captured by politicians and banks. Therefore, empowering private market discipline would be helpful in mitigating banks' excessive risk taking (Hay and Shleifer, 1998; Barth et al., 2004). However, as warned by Crockett (2002, p.979), for private market discipline to be fully effective in ensuring financial stability, four prerequisites have to be met. First, market participants need to have sufficient information to reach informed judgements. Second, they need to have the ability to process it correctly. Third, they need to have the right incentives. Finally, they need to have the right mechanisms to exercise discipline. Moreover, the lack of an efficient functioning legal system would seriously compromise the operation of private market discipline. Consistent with this argument, Beck et al., (2006) find that supervisory practices, which force information disclosure by banks, work best to promote integrity in lending in countries that adhere to the rule of law.

With respect to the proxy for the restrictions on bank activities, we follow Gonzalea (2005) and use the Financial Freedom Index (*FREE*) published annually for each country by Heritage Foundation[13] since 1995. The Index reflects a country's financial climate: it measures the extent of government regulation of financial services; the extent of state intervention in banks and other financial services; the difficulty of opening and operating financial services firms (for both domestic and foreign individuals); and government

[13] Gonzalea (2005) calculate the correlation between the Heritage Financial Freedom Index (HFFI) and the summary index of the level of regulatory restrictions on banks to engage in three non-traditional activities (SECURITIES, INSURANCE, and REAL ESTATE) and to own and control non-financial firms (BANKOWN). It is found that the HFFI captures freedom for banks to engage in the three activities.

influence on the allocation of credit. The overall score is scaled 0 – 100, with higher values indicating lower degrees of restriction. In theory, the increase in financial freedom has opposite implications for the risks banks are taking. It allows banks to take on risky business, which may erode the safety and soundness of banks' balance sheet. However, financial freedom offers banks opportunities to utilize economies of scope and scale, and to explore new profit generation and risk diversification. Further, it increases the operational autonomy and accountability of banks and incentivises banks to invest in information collection during the course of credit supply and to exercise creditors' right to recover bad debt. Overall, therefore, increased financial freedom may reduce the risks taken by banks. Indeed, a negative relation between regulatory restrictions on bank activities and the stability of the banking system is found by Barth et al. (2006) and Gonzalez (2005). Also, Pasiouras et al. (2006) find that lower restrictions on bank activities result in higher credit ratings of banks.

Finally, we define a dummy variable (*INSUR*) for the presence of explicit deposit insurance to control for its influence on risk taking incentives. It has been long suggested that deposit insurance may intensify the moral hazard problem of banks since depositors are less likely to enforce market discipline on banks (Demirguc-Kunt and Kane, 2002; Gonzalez, 2005). Based on information from Demirguc-Kunt et al., (2005) and the International Association of Deposit Insurers, the dummy variable takes a value of one from the year when the explicit deposit insurance was put into effect, and zero prior to it.

4.4 Macroeconomomic indicators

To take into account the macro-economic variables (M_{jt}) that may have influence on risks banks are taking, we use the inflation rate (*INFLA*) and the natural logarithm of GDP (constant 2000 US dollar) (*LNGDP*) for each country over 1996-2008, collected from the African Development Indicators. Higher inflation distorts decision-making, exacerbates information asymmetry and introduces price volatility; hence, we predict a positive relationship between inflation and bank risk taking. *LNGDP* serves as a proxy for a country's economic development, and is expected to be negatively related to bank risk.

4.5 Bank-specific variables

To allow for the bank-specific characteristics (B_{jit}) that might explain cross-bank differences in default risks, we include the return on total assets (*ROA*), measured by the ratio of pre-

taxation profit over total assets, to capture the impact of franchise value on bank-risk taking. As argued by Gonzalez (2005), more profitable banks would more likely institute conservative investment policy since they face higher opportunity cost of going bankruptcy. To capture the impact of scale diversification, we include *MARSHAR*, which is measured by the stock of loans of bank *i* as percentage of the sum of the stock of all the sample banks belonging to the same country as bank *i*. We further include a measurement of scope diversification (*SP*), namely the Herfindahl index of income concentration, i.e. $SP = \sum_{i=1}^{2} S_i^{\,2}$, and $S_i = y_i / \sum_{i=1}^{2} y_i$, y_1 refers to interest-income and y_2 refers to non-interest income. *SP*=1 means that the bank is totally specialized, and *SP*=0.5 means that the bank produces totally diversified income (i.e. interest income and non-interest income have the equal share in total income). A smaller value indicated a better diversified income structure. Finally, to capture cross-bank differences in the quality of risk management skill, we include *SKILL*, which is computed by non- interest overhead costs divided by the total earning assets of the bank. A higher value indicates a lower management skill.

In the second stage of the analysis, Equation (13) incorporates one-time period lag of the predicted value of default risk of banks ($\hat{RISK}_{ji(t-1)}$) with our key variables of national institutional setting for the protection of creditor rights (i.e. *LEG*, *ENFOR*, and *SHAR*) with other control variables. The dependent variable is the proportion of total earning assets allocated by the bank *i* to loans at time *t(CREDITRATIO)*, measured by the ratio of total loans to the sum of total loans and government securities. While we control for the same set of macroeconomomic indicators (i.e. M_{jt}) in equation (13), the regulatory variables (R_{jt}) and bank-specific variables ($BANK_{jit}$) that are included in Equation (13) are slightly different from that in Equation (12). Such change is mainly due to the change in our selection criterion: we now attempt to control for the potential explanatory influences on the cross-bank differences in the proportion of total earning assets allocated to loans, which is not transmitted through their impacts on default risk of banks. Specifically, the regulatory variables included in R_{jt} are the stringency of regulatory capital requirement adopted by the authorities (*CAPRQ*), the power granted to authorities to intervene in bank's decisions (*OFFPR*), private monitoring (*PRI*) and financial freedom index (*FREE*). We hypothesize that the regulatory variables impact on the operational autonomy, constraints and competitive

pressure banks face and therefore affect the bank's selection of the asset portfolio. The bank-specific variables included in $BANK_{jit}$ are the market share of bank *i* in the national lending market (*MARSHAR*), the ratio of fixed assets over total assets (*FIX*), the ratio of liquid assets over customer and short-term funding (*LIQ*), and the ratio of capital over total risky assets[14] (*CAP*). We control for *MARSHAR* and *FIX* is to capture the impact of customer base and physical distributional channel on banks' credit supply. We expect that banks with larger market share and more extensive networks would have higher ratio of loans over total earning assets. We control for *LIQ* to capture the preference of banks toward holding public security that is driven by liquidity mismatch of banks. If the motivation of banks to hold more liquid security is because banks are in shortage of liquidity, we would have a positive coefficient for *LIQ*. Finally, we control for the ratio of capital over total risky assets (*CAP*). As shown in Equation (7), the impact of the heterogeneity across banks in the level of capitalization on bank's asset allocation is determined by whether equity capital is more expensive than deposits. In addition to the macroeconomomic indicators (M_{jt}), the regulatory variables (R_{jt}) and bank-specific variables ($BANK_{jit}$), we introduce the difference between interest rate on loans and that on public security (*MAR*) into Equation (13). We measure it using the implicit interest rate charged by banks on loans minus the "risk free" (treasury bill) interest rate at which short-term government securities are issued or traded in the market. The implicit interest rate on loans is calculated by the interest income on loans divided by total loans. The data on the risk-free (treasury bill) interest rate were collected from the African Development Indicators. We predict a positive coefficient for *MAR* and a negative coefficient for $\hat{RISK}_{ji(t-1)}$.

Both equations include a set of dummy time variables ($TIME_t$) for each year. These dummies capture any unobserved regional shock. Finally, εj_{it} and ωj_{it} are white-noise error terms. We did not include either country-level or bank-level fixed effect because the time variation of national institutional setting variables on the protection of creditor rights is rather limited. The explanatory power of variables that change slowly over time would be mopped up by the fixed effects. Also, we cannot introduce both country-level or bank-level fixed effects simultaneously since for all banks located in the same country, the bank-specific fixed

[14] Total risk assets include: total loans (net), other listed securities, other securities, equity investments, securities, bonds, non-listed securities, other investments, deferred tax receivable, other non earning assets, and intangible assets (i.e. line 7480 in BankScope).

effect will overlap with country-specific fixed effect. The analysis is applied to a sample composed by commercial banks in 20 African countries during 1995-2008. The choice of the sample countries is directed by the availability of our key variable of interests. The bank-specific variables including the dependent variables in Equation (12) and (13) are constructed from bank-level financial data from BankScope database. The definition of the variables and the data sources are given in the Appendix. Table 1 presents the summary statistics of variables, and Table 2 reports the correlation coefficient of the variables.

<INSERT TABLE 1 AND TABLE 2 HERE>

5. Econometric issues and empirical results

5.1 Econometric issues

Given our panel data set, we consider pooled Ordinary Least Square (OLS), random-effect models and fixed-effect models, as possible estimators. Due to the limited variation of our key legal and institutional variables of interest, we narrow our options to pooled OLS and the random effects model for the first and second stages of estimation and testing. For both stages, the Breusch and Pagan (1980) Lagrange multipier test (LM) suggest a rejection of the null hypothesis that individual bank effects are not relevant, which suggests that the random effect model is preferred to the pooled OLS estimator. Another econometric issue we have to deal with is the possibility of the endogeneity of legal rights code in our estimated equations[15]. In theory, the reverse causality would take place whenever the policy makers make adjustment on the legal rights code, according to their knowledge on bank risk-taking and bank asset-allocation. However, as argued by Houston et al. (2010), the reverse causality would be less of a concern in the examination of individual bank firms, although it would be serious in a pure cross-country analysis. In addition, the use of the index rank of legal rights rather than the index of legal rights in our study would reduce the endogeneity, if any. Indeed, the endogeneity test in the first (Equation (12)) and second stage (Equation (13)) fail to reject the null hypothesis that the specified endogenous regressors can actually be treated as exogenous[16]. We further carry out the endogeneity test of *MAR*, i.e. the difference in the interest rate charged by banks on loans to prime private sector customers minus the "risk

[15] Since our indicator of enforcement of creditor rights is a perception-based index, it may be endogenous.
[16] The instruments we use for the tests are longitude and latitude, following the geographical endowment view on the formation of long-lasting institutions.

free" (treasury bill) interest rate at which short-term government securities are issued or traded in the market, in our second stage analysis. As shown in our analytical framework (Equation (2)), the change in the quantity of credit supply by the bank would be transited to the interest rate at the industry-level. We fail to reject the null hypothesis that the specified endogenous regressors can actually be treated as exogenous (P-value is 0.3)[17]. To take into account the independence of the bank-specific dependent variables within a country since their exposure to the common unobservable country effects, we cluster the heteroskedasticity-robust standard errors by country.

5.2 First stage: the impact of legal rights, the enforceability of legal rights and information sharing on bank risk-taking

The random effects estimation results for equation (13) are presented in Table 3 (column 2).

<INSERT TABLE 3 HERE>

The key variables of interest are the legal rights index, the enforcement of legal rights and the presence of informational sharing. As shown in Table 3, the first-stage analysis results indicate that the presence of informational sharing mechanism and the strength of legal code do not have significant effect on bank risk-taking. The results, therefore, appear to be consistent with the view that stronger legal rights and information sharing may not necessarily translate into a decrease in the average default rate of the loan portfolio even if it leads to a lower default rate of an individual borrower. However, the enforceability of legal rights has a statistically significantly negative impact. Specifically, the magnitude of the coefficient on *ENFOR* suggests that one standard deviation increase in the enforceability of legal rights (0.662) is associated with a change in the ratio of loan loss provision by -1.149 (=0.662*-1.736). Given that the mean of the ratio of loan loss provision is 3.175, the effect is not only statistically significant but also economically significant.

Regarding the regulatory variables, we find that an increase in financial freedom *(FREE)* induces a decrease in bank risk-taking, consistent with the insight of Barth et al., (2001) and Gonzalez (2005). We also find that increased stringency of capital requirements *(CAPRQ)* leads to an increase in the risks banks are taking, in accordance with the argument that banks under more restrictive regulatory capital requirements incur more cost of financial intermediation associated with raising capital and therefore decline to take risky investment

[17] The instrument we use for the test is one time period lag of *MAR*.

to neutralize the cost. However, private monitoring *(PRI)* and the existence of explicit deposit insurance scheme *(INSUR)* have no significant impact. The evidence which shows insignificant effect of the presence of explicit deposit insurance is consistent with the view that deposit insurance per se is not subject to moral hazard, we believe it could result from a combination of the low presence of the explicit deposit insurance scheme in our sample countries[18], and the existence of implicit insurance in the countries that lack explicit deposit insurance schemes (Demirgüç-Kunt et al., 2005). Furthermore, the low competence and the shortage of right mechanism for depositors to monitor bank activities in both countries with explicit and implicit insurance may also contribute to the insignificant result. [19] With respect to other control variables, we find that banks with higher profitability *(ROA)*, higher management skill *(SKILL)*, and larger market share *(MARSHAR)* have a lower level of risk-taking. We also find that lower inflation *(INFLA)* and higher GDP (*LNGDP*) are correlated with lower risk-taking by banks.

5.3 Second stage: The impact of legal creditor rights, the enforceability of legal rights and information sharing, on bank asset-allocation

The random effects estimation results for equation (14) are presented in Table 4 (column 2) [20].

<INSERT TABLE 4 HERE>

We first check the consistency of our estimated results with the analytical framework on which our empirical analysis is based. The significant positive coefficient for *MAR* and a significant negative coefficient for $\hat{RISK}_{ji(t-1)}$ confirm the prediction of Equation (7) that a larger difference between the interest rate charged by banks on loans minus the "risk free" treasury bill interest rate at which short-term government securities are issued or traded in the

[18] Only 5 out of 20 sample countries have explicit deposit insurance in place, namely, Kenya (1988), Nigeria (1989), Tanzania (1994), Uganda (1994) and Zimbabwe (2003).

[19] Andrianova et al., (2008) point out the deviation of the presence of explicit deposit insurance from the credibility of the promise of compensation in practice would also contribute the insignificant effect. For example, it takes 5 year average waiting time to receive compensation in Kenya.

[20] Predicted values, of default risks of a bank derived from the first stage analysis, smaller than zero are excluded from the second stage. A two-stage estimation procedure that does not account for the presence of an estimated regressor (in our case, the predicted default risk) in the second stage will produce inconsistent and biased standard errors. Murphy and Topel propose a method to estimate the correct asymptotic covariance matrix for the second step estimator which, though applicable to panel data models, is computationally difficult to implement. As an alternative, we utilize a bootstrap to obtain consistent estimates of standard errors in stage two, following Vidovic and Khanna (2007) and Guan (2003) among others.

market, keep other things equal, lead the bank to allocate more their loanable funds to loans[21], while the increase in the bank's expectation of default risks leads banks to decrease the bank's asset-allocation to loans, confirming the conjecture that a high loan default rate is the major factor for most banks in Africa to choose to shed away from the provision of credit.

In terms of the key variables of interest, we find that stronger legal rights (*LEG*), more effective enforcement of legal rights (*ENFOR*), and the presence of information sharing institutions (*SHAR*) all are significantly associated with a higher proportion of loans, through the net impact on degree of competition and the operating cost of information production. The results on market share (*MARSHAR*) and the ratio of fixed assets over total assets (*FIX*) indicate that the larger market share and higher ratio of fixed assets over total assets lead a significant increase in the proportion of loans over total earning assets, supporting the positive role of consumer base and distribution channel on the bank's credit supply. Also, the significant negative coefficient on the capitalization ratio implies that the increase in the capitalization ratio leads to a decrease in the proportion of loans over total earning assets, which is the predicted result in the case where funding cost of equity capital is more expensive than deposits. Finally, the insignificant negative coefficient on liquidity assets over liquidity liability ratio *(LIQ)* suggests that managing liquid risks is not the reason for banks to reduce credit supply. To deal the concern that the estimated coefficient on *LIQ* may be contaminated by the presence of a reverse relation from the dependent variable to LIQ, i.e. banks that hold higher government securities (lower loans) have higher liquid assets. We redo our estimation of the Equation (13) by replacing contemporary *LIQ* with one time period lag of LIQ as the independent variable. The results are presented in Table 5: the coefficient on one period lag of LIQ is small and insignificant, while other results remain unchanged.

We further consider two additional robustness tests. First, we introduce one more macro-variable, namely real GDP per capita growth rate (constant 2000 US dollar) (GDPPERCAPTA) into both first and second stage analysis. As argued by Djankov et al., (2007), rapid economic expansion may requires more credit. The data is collected from African Development indicator. The results are reported in Table 6 and Table 7 respectively. Secondly, we examine whether our results hold when alternative measure of the enforceability of the legal rights is used. Here, we consider the "Control of Corruption"

[21]This reflects the view of Hannan (1991) that the optimal asset-allocation of banks is determined by the extent to which it is profitable for the bank to replace securities with loans in the bank's portfolio..

constructed by Kaufmann et al., (2009). The index is a measurement of the perceptions of a very diverse group of respondents regarding the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. As documented by Kaufmann, et al., (2005), the perception-based corruption indicator explains a good deal of the extent to which a de jure notion of laws 'on the books' that differs substantially from the de facto reality that exists 'on the ground'. Therefore, it would be a suitable indicator to measure the extent to which laws on books are effectively applied in practice. Higher values indicate better control of corruption and more effective implementation of the written laws. The results are presented in Column 3 in Table 3 and 4 for the first and the second stage analysis, respectively. In both cases, the empirical results are highly consistent with our previous findings.

<INSERT TABLES 5-7 HERE>

Hence our results on the first and the second stages indicate that the stronger creditor rights, the presence of information sharing and the increase in the effectiveness of the enforcement of creditor legal rights leads to an increase in the proportion of loans over total earning assets, which is consistent with the essential idea of the law and finance literature that some environments are more conducive to writing and enforcing financial contracts than others, and that better contracting leads to a higher financial depth. However, those three aspects of the institutional setting on the protection of creditor rights appear to materialize their influence in different manners. While the stronger creditor rights, the presence of information sharing exert their impact through a composite effect of the enhancement of competition and the reduction of the operating cost of information production, the increase in the effectiveness of the enforcement of creditor legal rights does it through mitigating default risks of banks as well as the composite effect of enhancing competition and reducing the operating cost of information production. In addition, for the enforcement of creditor legal rights, the latter channel is stronger than the former. To be specific, one standard deviation increase in the enforceability of legal rights (0.662), keep other things equal, is associated with a change in the proportion of loans over earning assets by 4.876 {=(-0.454)*(-1.149)+(0.662*6.578)}, 76% of which (=1-(1.149/4.876)) contributes to the latter channel.

6. Conclusion

Recent research on the relation between the institutional setting for the protection of creditor rights and the development of the credit market offers macro-level evidence to the effect that the quality of the legal protection, enforceability of legal creditor rights and improvements in information sharing among creditors, are positively associated with the depth of the financial system. However, the mico-analysis to identify and quantify the specific mechanisms through which the institutional environment for the protection of creditor rights gets transmitted to the credit market is less developed. In this paper, inspired by Klein (1970, 1971) and Hannan (1991), we set up an analytical framework for the allocation of a bank's loanable funds between private credit (loans) and other competing stock of earning assets, within a general model of a bank's portfolio selection. The model captures an operational environment characterized by risk, imperfect asset elasticity and operating costs, We then link the institutional setting for the protection of creditor rights (encompassing legal rights for creditors, the enforcement of legal rights and information sharing mechanism among creditors) with the default risks banks are facing, the degree of competition in the credit market and banks' operating cost associated with information production and contract enforcement. Finally, we test whether and how the institutional settings for the protection of creditor rights affect the three channels and ultimately influence banks' credit supply.

Using a three-dimensional unbalanced panel dataset of banks in 20 African countries over 1995-2008, we obtain evidence which suggests that better institutional setting for the protection of creditor rights (in terms of higher level legal codes for creditors, better enforceability of legal rights, and the presence of informational sharing among banks) encourage banks to allocate a significantly higher proportion of their earning assets to loans. This micro-level evidence is consistent with existing macro-level evidence. However, the three aspects of institutional setting appear to work through different channels. While the enforceability of legal rights works through mitigating banks' credit risks, and a composite net effect of promoting competition in the credit market and reducing banks' operating cost of informational acquisition, legal codes and information sharing materialize their positive effect through the composite effect on competition in the credit market and banks' operating cost of informational acquisition only.

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Appendix: Variable definition and data sources

Variable	Definition and data source
National institutional setting on the protection of creditor rights.	
RULE OF LAW	A measurement of the perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. Data source: Kaufmann et al., (2009).
CONTROL OF CORRUPTION	A measurement of the perceptions of a very diverse group of respondents regarding the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. Data source: Kaufmann et al., (2009).
LEG	A measurement of the legal right of secured creditor in bankruptcy against defaulting borrowers. Data source: Djankov et al., (2007) and the World Bank's Doing Business Index.
SHARE	A dummy variable with a value one from the year when either a public registry or a private bureau starts to operate in a country and onwards, and zero prior to it. Data source: Djankov et al., (2007) and the World Bank's Doing Business Index.
Industry regulatory variables	
CAPRQ	Defined by answering the following questions: (1) Is the minimum required capital asset ratio risk-weighted in line with Basle guidelines? (2) Does the ratio vary with individual bank's credit risk? (3) Does the ratio vary with market risk? (4–6) Before minimum capital adequacy is determined, which of the following are deducted from the book value of capital: (a) market value of loan losses not realized in accounting books? (b) unrealized losses in securities portfolios? (c) unrealized foreign exchange losses? (7) Are the sources of funds to be used as capital verified by the regulatory/supervisory authorities? (8) Can the initial or subsequent injections of capital be done with assets other than cash or government securities? (9) Can initial disbursement of capital be done with borrowed funds? The value is determined by adding 1 if the answer is yes to questions 1–7 and 0 otherwise, while the opposite occurs in the case of questions 8 and 9 (i.e. yes=0, no =1). Data source: three surveys performed by the World Bank in 2000, 2003 and 2008.
OFFPR	Defined by answering the following questions: (1) Can the supervisory authorities force a bank to change its internal organizational structure? (2) Are there any mechanisms of cease-desist type orders whose infraction leads to automatic imposition of civil & penal sanctions on banks directors & managers? (3) Can the supervisory agency order directors/ management to constitute provisions to cover actual/potential losses? (4) Can the supervisory agency suspend director's decision to distribute dividends? (5) Can the supervisory agency suspend director's decision to distribute bonuses? (6) Can the supervisory agency suspend director's decision to distribute management fees? (7) Can the supervisory agency supersede bank shareholder rights and declare bank insolvent? (8) Does banking law allow supervisory agency to suspend some or all ownership rights of a problem bank? (9) Regarding bank restructuring & reorganization, can supervisory agency remove and replace management? (10) Regarding bank restructuring & reorganization, can supervisory agency remove and replace directors? The value is determined by adding 1 if the answer is yes to questions 1-

	10 and 0 otherwise. Data source: three surveys performed by the World Bank in 2000, 2003 and 2008.
PRI	The value is determined by adding 1 if the answer is no to questions 1, while the opposite occurs in the case of questions 2-10 (i.e. yes=0, no =1): (1) Does accrued, though unpaid interest/principal enter the income statement while loan is non-performing? (2) Are financial institutions required to produce consolidated accounts covering all bank and any non-bank financial subsidiaries? (3) Are off-balance sheet items disclosed to supervisors? (4) Are off-balance sheet items disclosed to public? (5) Must banks disclose their risk management procedures to public? (6) Are directors legally liable for erroneous/misleading information? (7) Is an external audit compulsory? (8) Are there specific requirements for the extent of audit? (9) Are auditors licensed or certified? (10) Do regulations require credit ratings for commercial banks? Data source: three surveys performed by the World Bank in 2000, 2003 and 2008.
INSUR	A dummy variable that takes a value of one from the year when the explicit deposit insurance was put into effect, and zero prior to it. Data source: Demirguc-Kunt et al., (2005) and the International Association of Deposit Insurers.
FREE	The Financial Freedom Index measuring the extent of government regulation of financial services, the extent of state intervention in banks and other financial services, the difficulty of opening and operating financial services firms (for both domestic and foreign individuals), and government influence on the allocation of credit. Data source: Heritage Foundation.
Macro-economics variables	
LNGDP	The natural logarithm of GDP (constant 2000 US dollar). Data source: African Development Indicator
INFLA	Inflation GDP deflator. Data source: African Development Indicator
Industry-wise variable	
MAR (%)	The difference between the implicit interest rate charged by banks on loans and the "risk free" treasury bill interest rate at which short-term government securities are issued or traded in the market. Data source: BankScope and African Development Indicator.
Bank-specific variables	
RISK (%)	Provision/total loans. Data source: BankScope
ROA (%)	Pre-taxation profit/total assets. Data source: BankScope
SKILL (%)	Overhead/(loans + total other earning assets). Data source: BankScope
MARSHAR (%)	Loans of bank I at year t/the sum of loans of commercial banks belonging to the same country. Source: BankScope, Author calculation.
SP	$SP = \sum_{i=1}^{2} S_i^{\,2}$, and $S_i = y_i / \sum_{i=1}^{2} y_i$, y_1 refers to interest-income and y_2 refers to non-interest income. Source: BankScope, Author calculation.
ASSET_ALLOCATION (%)	Loans/(loans + government securities). Data source: BankScope.
FIX (%)	Fixed assets/ total assets. Data source: BankScope.
CAP(%)	Total equity/total risky assets. Data source: BankScope.
LIQ (%)	Liquidity assets/ customer and short-term funding. Source: BankScope.

Table 1: Summary Statistics

Variable	Mean	Std. Dev.	Min	Max
RULE OF LAW	-0.468	0.662	-1.717	0.940
CONTROL OF CORRUPTION	-0.465	0.665	-1.757	1.071
LEG	0.671	0.283	0.000	1.000
SHAR	0.626	0.484	0.000	1.000
CAPRQ	5.688	1.836	2.000	9.000
OFFPR	8.024	2.700	1.000	10.000
PRI	7.474	1.489	3.000	10.000
INSUR	0.387	0.487	0.000	1.000
FREE	45.421	15.682	10.000	70.000
LNGDP	23.612	1.566	19.873	25.929
GDPPERCAPTA	2.336	3.273	-17.145	22.618
INFLA	17.010	123.143	-5.755	5399.526
MAR	25.341	21.202	0.103	297.172
DEFAULT RISK	3.175	5.552	0.000	90.715
ROA	2.704	3.209	-16.636	29.647
SKILL	7.024	7.637	0.000	131.318
MARSHAR	10.162	13.748	0.001	100.000
SP	0.595	0.125	0.500	1.000
ASSET-ALLOCATION	55.569	19.540	15.138	94.943
FIX	3.585	4.227	0.000	49.944
CAP	25.285	25.207	0.447	508.787
LIQ	57.767	157.675	0.130	5575.393

Note: The 20 African countries includes Algeria, Angola, Botswana, Burundi, Egypt, Ethiopia, Kenya, Lesotho, Madagascar, Malawi, Morocco, Mozambique, Namibia, Nigeria, Rwanda, South Africa, Tanzania, Uganda, Zambia, and Zimbabwe. Again, the sample selection is dictated by the availability of the data

Table 2: Correlation Matrix for the endogenous and explanatory variables

	RISK	ROA	SKILL	MSR	SP	GDP	INFL	CAPR	OFFP	PRI	SHAR	INSU	FREE	ROL	COC	LEG	AL	MAR	FIX	CAP	LIQ
RISK	1.0																				
ROA	-.23	1.0																			
SKILL	.29	.096	1.0																		
MSR	-.03	.091	-.119	1.0																	
SP	.04	.009	.045	.003	1.0																
GDP	-.02	-.15	-.06	-.496	-.07	1.0															
INFL	.09	.125	.012	.105	.041	-.03	1.0														
CAPR	.03	.086	.158	-.188	.063	.205	-.05	1.0													
OFFP	.07	.048	.022	-.063	-.14	-.16	.029	-.093	1.0												
PRI	-.02	-.06	-.067	-.26	-.04	.528	.005	.207	.074	1.0											
SHAR	-.01	-.11	-.073	-.183	-.09	.48	-.08	.139	-.158	.44	1.0										
INSU	-.12	.06	.195	-.279	.01	.185	.02	.318	.444	-.1	-.17	1.0									
FREE	-.16	-.13	-.041	.028	.063	-.16	-.096	.075	-.209	.04	-.09	-.24	1.0								
ROL	-.21	-.21	-.288	.119	.07	-.02	-.122	-.01	-.384	.25	.11	-.64	.571	1.0							
COC	-.20	-.15	-.232	.166	.11	-.01	-.089	.074	-.593	.19	.21	-.68	.551	.895	1.0						
LEG	.013	.145	.164	-.193	-.14	.181	.056	.258	-.102	-.2	-.06	.332	.016	-.28	-.15	1.0					
AL	-.16	-.11	-.058	.104	.141	.048	-.046	-.025	-.341	.02	.19	-.26	.189	.273	.39	-.02	1.0				
MAR	.19	.12	.43	-.07	.09	.01	.04	.03	-.03	-.08	.01	.01	.06	-.06	-.02	-.16	.13	1.0			
FIX	.193	.019	.596	-.022	.026	-.11	-.002	.133	.039	-.1	-.06	.14	-.097	-.26	-.21	.087	-.05	.22	1.0		
CAP	.034	.058	.114	-.115	.046	.009	-.002	.051	.004	-.3	-.01	.108	-.051	-.08	-.07	-.01	-.28	.08	.178	1.0	
LIQ	.061	.022	.079	-.076	-.01	.048	.007	.062	.037	-.3	-.03	.129	-.083	-.12	-.12	.081	-.14	.04	.019	.134	1.0

Key: Variables are defined as in the Appendix table.

Table 3: The quality of institutional setting on the protection of creditor rights and bank risk-taking

	Column 2		**Column 3**	
	Rule of law		Control of corruption	
	Coef.	Robust Std. Err	Coef.	Robust Std. Err
ROA	-0.645***	0.273	-0.643***	0.274
SKILL	0.165***	0.053	0.165***	0.052
MARSHAR	-0.028*	0.017	-0.027*	0.017
SP	1.051	0.858	1.250	0.897
LNGDP	-0.721***	0.286	-0.754***	0.293
INFLA	0.006***	0.001	0.006***	0.001
CAPRQ	0.259**	0.119	0.290***	0.113
OFFPR	-0.102	0.073	-0.187***	0.072
PRI	0.335	0.210	0.317	0.214
INSUR	-0.223	0.568	-0.428	0.537
FREE	-0.032**	0.018	-0.031*	0.019
SHAR	0.552	0.464	0.706	0.458
ENFOR	-1.736***	0.575	-1.947***	0.473
LEG	-0.615	0.663	-0.152	0.754
Within R-square	0.2216		0.2250	
Between R-square	0.2724		0.2657	
Overall R-square	0.2425		0.2423	
No. of Obs.	2180		2174	
No. of countries	20		20	

Note: Dependent variable is the ratio of loan loss provision over total loans. The estimation is based on a random-effect model. The column 2 contains the results when the enforcement of legal rights is measured by Rule of Law index and the column 3 reports the results when the enforcement of legal rights is measured by Control of Corruption index. The heteroskedasticity-robust standard errors are clustered at the country level. *, **, *** indicates statistical significance at the 10%, 5%, and 1% levels, respectively. Time dummy is included in the estimation while are not reported. The number of observations in the case when the enforcement of legal right is measured by the Rule of Law index is larger since the Rule of law indicator is available for Rwanda, Burundi, and Lesotho in 1995 and 1996 while Corruption Control Index is not.

Table 4: The quality of institutional setting on the protection of creditor rights and bank asset-allocation

	Column 2		**Column 3**	
	Rule of law		Control of corruption	
	Coef.	Bootstrapped Std Err	Coef.	Bootstrapped Std Err
MAR	0.148***	0.053	0.147***	0.054
$\hat{RISK}_{ji(t-1)}$	-0.454*	0.255	-0.463*	0.251
FIX	0.956***	0.300	0.963***	0.292
CAP	-0.190***	0.072	-0.181**	0.072
MARSHAR	0.284**	0.142	0.319**	0.141
LIQ	-0.023	0.044	-0.023	0.042
LNGDP	0.723	1.040	1.103	1.072
INFLA	-0.007	0.023	-0.007	0.023
CAPRQ	-0.599	0.555	-0.571	0.544
OFFPR	0.066	0.504	0.394	0.551
PRI	-0.324	0.780	-0.714	0.759
FREE	0.060	0.056	0.047	0.056
SHAR	6.865***	2.416	6.575***	2.358
ENFOR	6.578***	2.027	8.333***	2.132
LEG	11.654**8	2.723	9.684***	2.655
No. of countries	20		20	

Note: Dependent variable is the ratio of total loans over the sum of loans and government securities. The estimation is based on a random-effect model. The column 2 contains the results when the enforcement of legal rights is measured by Rule of Law index and the column 3 reports the results when the enforcement of legal rights is measured by Control of Corruption index.

$\hat{RISK}_{ji(t-1)}$ in column 2 and column 3 is the predicted value corresponding to column 2 and 3 in Table 3 respectively. The predicted values that are smaller than zero are trimmed in the second stage analysis.

The bootstrapped standard errors are clustered at the country level. *, **, *** indicates statistical significance at the 10%, 5%, and 1% levels, respectively. Time dummy is included in the estimation while are not reported.

Table 5: The quality of institutional setting on the protection of creditor rights and bank asset-allocation with one time period lag of liquidity mismatch

	Coef.	Bootstrapped Std Err
MAR	0.147***	0.054
$\hat{RISK}_{ji(t-1)}$	-0.512**	0.253
FIX	0.995***	0.312
CAP	-0.200***	0.070
MARSHAR	0.286**	0.140
One time period lag of LIQ	0.000	0.017
LNGDP	0.702	1.073
INFLA	-0.007	0.024
CAPRQ	-0.661	0.504
OFFPR	0.074	0.530
PRI	-0.241	0.817
FREE	0.063	0.059
SHAR	6.921***	2.352
ENFOR (rule of law)	7.240***	2.003
LEG	11.734***	2.774
No. of countries		20

Note: the table contains the results of estimating Equation (13) with rule of law as the measurement of the legal code of creditor right, while replacing contemporary LIQ with one-time period lag of LIQ. The dependent variable is the ratio of total loans over the sum of loans and government securities. The estimation is based on a random-effect model. $\hat{RISK}_{ji(t-1)}$ is the predicted value corresponding to column 2 in Table 3. The predicted values that are smaller than zero are trimmed off.
The bootstrapped standard errors are clustered at the country level. *, **, *** indicates statistical significance at the 10%, 5%, and 1% levels, respectively. Time dummy is included in the estimation while are not reported.

Table 6: The estimated results of the first-stage analysis with an additional macro-variable, exchange rate adjusted real GDP per capita growth rate (i.e. *GDPPERCAPTA)*

	Coef.	Robust Std. Err
ROA	-0.648**	0.270
SKILL	0.165***	0.053
MARSHAR	-0.026*	0.016
SP	1.000	0.846
LNGDP	-0.690***	0.278
GDPPERCAPTA	-0.090*	0.049
INFLA	0.006***	0.001
CAPRQ	0.245**	0.110
OFFPR	-0.079	0.068
PRI	0.290	0.203
INSUR	-0.203	0.538
FREE	-0.030*	0.018
SHAR	0.647	0.450
ENFOR (Rule of law)	-1.671***	0.553
LEG	-0.617	0.644
Within R-square		0.2235
Between R-square		0.2717
Overall R-square		0.2448
No. of obs.		2180
No. of countries		20

Note: Dependent variable is the ratio of loan loss provision over total loans. The estimation is based on a random-effect model. The heteroskedasticity-robust standard errors are clustered at the country level. *, **, *** indicates statistical significance at the 10%, 5%, and 1% levels, respectively. Time dummy is included in the estimation while are not reported.

Table 7: The estimated results of the second-stage analysis with the default risks of banks derived from Table 6 and an additional macro-variable, exchange rate adjusted real GDP per capita growth rate (i.e. *GDPPERCAPTA).*

	Coef.	Bootstrapped Std Err
MAR	0.149***	0.053
$\hat{RISK}_{ji(t-1)}$	-0.461*	0.262
FIX	0.955***	0.294
CAP	-0.189***	0.072
MARSHAR	0.289**	0.139
LIQ	-0.023	0.049
LNGDP	0.673	1.047
GDPPERCAPTA	0.035	0.174
INFLA	-0.007	0.024
CAPRQ	-0.588	0.535
OFFPR	0.035	0.495
PRI	-0.230	0.822
FREE	0.062	0.058
SHAR	6.798***	2.329
ENFOR(rule of law)	6.497***	2.018
LEG	11.261***	2.858

Note: Dependent variable is the ratio of total loans over total earning assets. The estimation is based on a random-effect model. $\hat{RISK}_{ji(t-1)}$ is the predicted value corresponding to the results in Table 6. The predicted values that are smaller than zero are trimmed off in the second stage analysis.
The bootstrap standard errors are clustered at the country level.*, **, *** indicates statistical significance at the 10%, 5%, and 1% levels, respectively. Time dummy is included in the estimation while are not reported.